7.0 Conclusions

As discussed in Section 1.1, the purpose of this report is to 1) determine the adequacy of the model to meet its stated objectives; and 2) if the model is adequate, determine and research or data that are needed to refine it. The following two subsections draw conclusions about each of these issues.

7.1 HYBRID MODEL ADEQUACY FOR OBJECTIVES

There are a considerable number and magnitude of overall uncertainties with the Hybrid Model that are driven by uncertainties, primarily in the AFT Model, and secondarily in the HST Model and FWM. Overall, the AFT Model is contributing most of the total uncertainty involved with the Hybrid Model. However, as discussed below, this uncertainty is not so great as to preclude some useful assessments of the primary model objectives.

As stated in Section 1.3 the modeling objectives specific to the Hybrid Model are:

- Estimate the contribution of surface water relative to sediment with respect to risk in tissue (primarily an RI objective).
- Evaluate the long-term impact on remedial action alternatives of ongoing sources of chemicals associated with unacceptable risk in sediment, the water column, and tissue (primarily an FS objective).
- Estimate acceptable sediment and water concentrations based on acceptable tissue concentrations (PRGs; primarily an RI objective).

For these first two objectives, it appears the overall Hybrid Model uncertainty prevents specific quantitative estimates of water, sediment, and tissue chemical concentrations that can be presented as "accurate" within a known degree. However, there is sufficient certainty within the model to allow an understanding of the relative importance of various fate and transport processes, various potential sources, and the relative outcome of various modeling scenarios.

Regarding the first objective, it appears that Hybrid Model helps to understand the basic relative magnitude of sediment resuspension as a contribution to water column chemical concentrations by providing a means to understand mass chemical flux caused by this process as compared to all other processes. It is anticipated that refinements to the HST Model regarding resuspension processes will help to refine the relative magnitude of this flux.

how will the refinements happen?

Regarding the second objective, the Hybrid Model can be used to understand the relative outcomes for future remedial scenarios and the relative importance of ongoing sources. For example, various scenarios can be run through the model and the ones that provide lowest long-term sediment, water, and tissue concentrations can be determined. However, it appears unlikely that conclusions can be drawn from the model about whether such concentrations will be above or below specific benchmark concentrations of concern. This also means that the utility of the model to predict "time to recovery" for tissue chemical concentrations in fish is expected to be limited.

Regarding the last objective, this can be achieved by running the FWM in isolation. Given that the FWM is predictive of measured tissue concentrations based on measured sediment and water concentrations within a factor of 5, it appears more than sufficient to meet the objective of PRG development for the RI.

Given this model functionality, it appears worthwhile to conduct limited research and data collection for some of the key AFT Model parameters that have the greatest chance to reduce uncertainty by the greatest amount. Such information could provide refined estimates of the relative importance of fate and transport processes or future remedial/source scenarios. Conversely, it is unclear whether any amount of research or data collection would be sufficient to reduce model uncertainty to levels that would allow quantifiably accurate future predictions of specific concentrations in any matrix (i.e., sediment, water, or tissue).

In addition, the above modeling evaluation is restricted to one chemical: 4,4'-DDD. It is unknown at this time to what extent conclusions about modeling objectives might vary if other chemicals were evaluated. It is also conceivable that such an exercise might lead to different data needs for some chemicals.

7.2 RESEARCH AND DATA NEEDS SUMMARY

7.2.1 Hydrodynamic and Sediment Transport Model

No additional research or data collection needs have been identified for the HST Model.

7.2.2 Chemical Abiotic Fate and Transport Model

The following research and data needs were identified to support further refinements of the AFT Model:

- Stormwater loading data to provide values for the ELW parameter. These data have already been collected in Round 3A, but are not yet available.
- Surface sediment data at historical locations to examine trends in sediment concentrations and assist in the calibration of sediment concentrations using the HLS parameter. This is a new data requirement.
- Select high-resolution sediment core data to examine trends in sediment concentrations and assist in the calibration of sediment concentrations using the HLS parameter. These data have already been collected and data will become available soon.

- Thorough literature search of sediment and water degradation rates to assist in refining the HLS term. This is a new research need.
- Upstream (transect at RM 11) surface water data for some additional flow conditions as feasible within project schedule (e.g., summer/fall 2007). This is a new data need.

7.2.3 Food Web Model

No additional research or data collection needs have been identified for the dynamic FWM that have not been identified for already for AFT Model.

7.3 PATH FORWARD

This document will be reviewed by EPA and partners, after which discussions will take place regarding the utility of the Hybrid Model and the need for any additional research or data collection to refine the model. This will likely include attempting to reach agreements on general scope, type, and magnitude of research and/or data collection such that LWG can prepare specific work plans and FSPs that are likely to meet with general EPA approval. The LWG would then implement any agreed to sampling or other research. The exact schedule of the negotiations, FSP development and approval, and sampling and research activities is dependent on numerous factors that are beyond the control of the LWG and cannot be exactly predicted at this time. However, to keep the overall RI/FS project on schedule, we anticipate that the following approximate schedule would need to be met:

- LWG and EPA to discuss and agree on research and data needs in August 2007
- LWG to submit work plans and/or FSPs by mid-September 2007
- EPA to approve work plans and/or FSPs by early October 2007

LWG will conduct sampling in October through December 2007. Purely paper research could extend well beyond this time without impacting the overall schedule.

The above schedule assumes that EPA or its partners would not request types or amounts of sampling that could not be collected within this time frame. Factors that might contribute to data collection moving past this time frame include requests for seasonally dependent sampling (e.g., more summer surface water data) or magnitude of sampling such that it cannot be completed in two months.

The future use of the Hybrid Model for the RI and FS will also need to be discussed with EPA. If the model is to be used for RI and FS objectives, then as a first step, the AFT Model will need to be recalibrated. This would be done both in terms of sediment and water concentrations using the additional data already being collected for Round 3A, as well as the additional research and data collection agreed to in the above processes. This recalibrated model would also be subjected to additional

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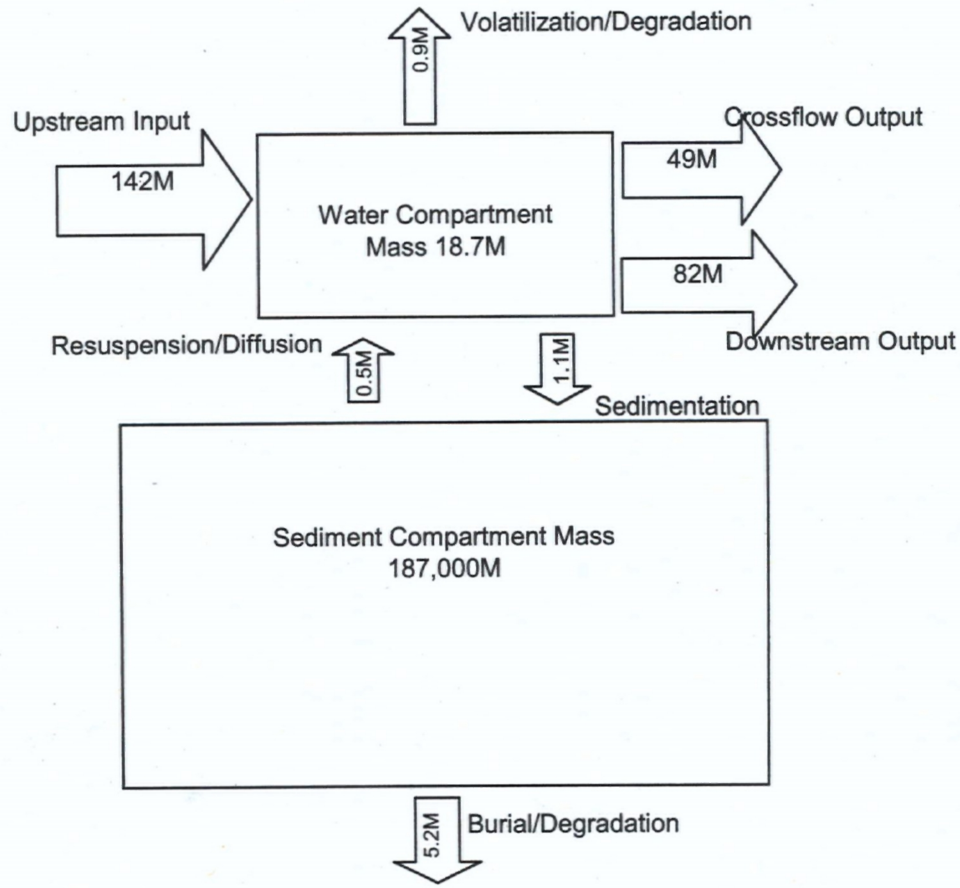
DDD Flux/Mass	Water Cell (ng)	Absolute Flux	Percent of Total Flux
Downtream Inflow	142,000,000	142,000,000	50%
Crossstream flow	-59,000,000	59,000,000	21%
Downstream Outflow	-82,200,000	82,200,000	29%
Volat/Degrad	-933,000	933,000	0.3%
Sedimentation	-1,100,000	1,100,000	0.4%
Resuspension	521,000	521,000	0.2%
Total Flux	-712,000	285,754,000	100%
Cell Mass*	18,700,000		1528%
Percent Net Mass Loss in This Time Step			-4%

DDD Flux/Mass	Sediment Cell (ng)	Absolute Flux	Percent of Total Flux
Sedimentation	1,100,000	1,100,000	16%
Resuspension	-521,000	521,000	8%
Burial/Degrad	-5,230,000	5,230,000	76%
Total Flux	-4,651,000	6,851,000	100%
Cell Mass*	187,000,000,000		0.004%
Percent Net Mass Loss in This Time Step			-0.002%
Ratio of Water Mass / Sediment Mass			0.01%
Ratio of Water Flux / Sediment Flux			4171%

Notes:

* Percent value in this row shows the percentage of flux per total cell mass.



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This document is currently under review by US EPA and its federal, state, and tribal partners, and is subject to change in whole or in part.

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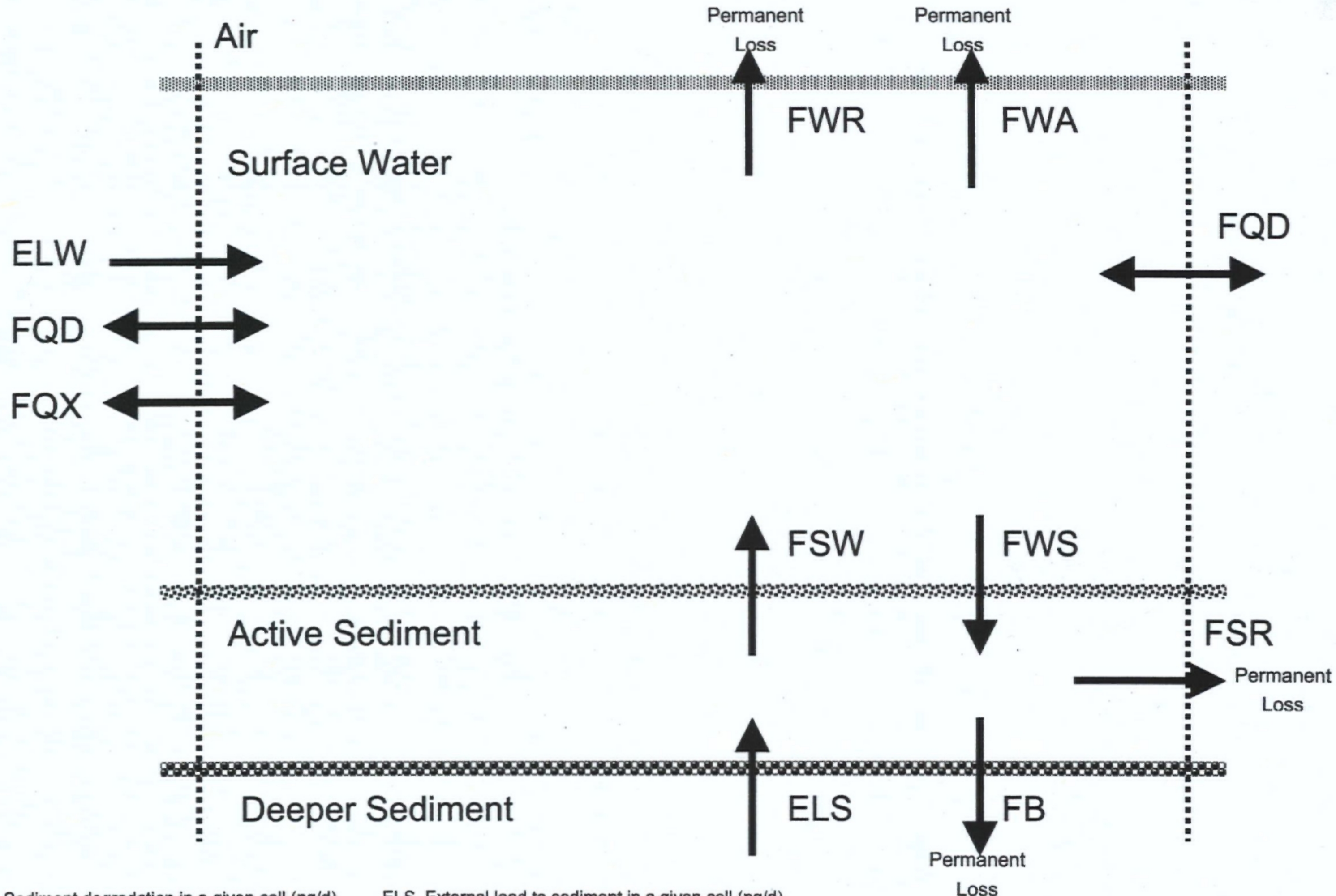
Figure 3-6
Chemical Fate and Transport Model Development and Data Gaps Identification Report
Analysis of Example Cell Mass Balance and Flux Rates



FSR Sediment degradation in a given cell (ng/d)
FSW Sediment-to-water flux in a given cell (ng/d)
FWA Volatilization flux in a given cell (ng/d)
FWR Water degradation in a given cell (ng/d)
FWS Water-to-sediment flux in a given cell (ng/d)

ELS External load to sediment in a given cell (ng/d)
ELW External load to water in a given cell (ng/d)
FB Sediment burial flux in a given cell (ng/d)
FQD Flux in/out of a given cell due to downstream/ upstream flow (ng/d)
FQX Flux into and out of a given cell due to cross flow (ng/d)

ANCHOR ENVIRONMENTAL, L.L.C.

Figure 3-1
Chemical Fate and Transport Model Development and Data Gaps Identification Report
Diagram of Modeled Processes for Each AFT Model Cell